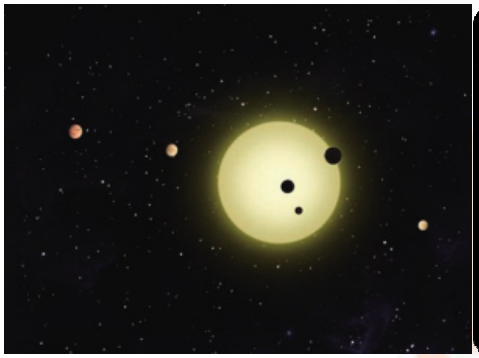
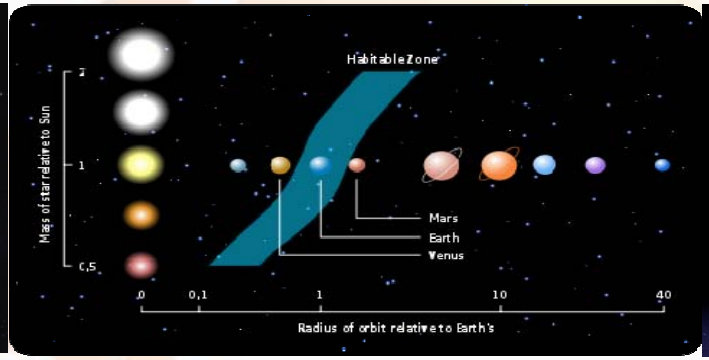
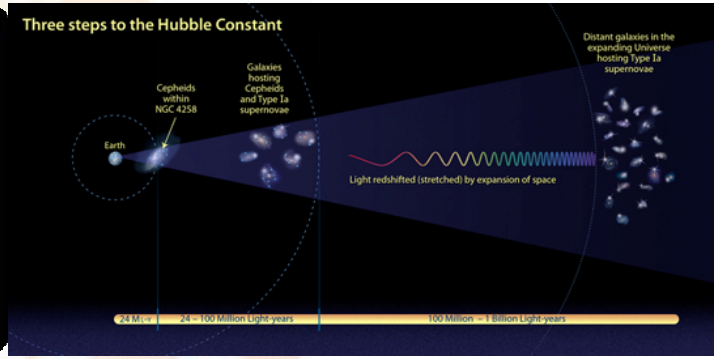
High precision Space Astromotry mission:
Search for nearby Terrestrial ExoPlanets(STEP)

Ding Chen (National Space Science Center, CAS)

➢**Science Objectives: High-precision Astrometry Mission for Extra-solar Planets detection**



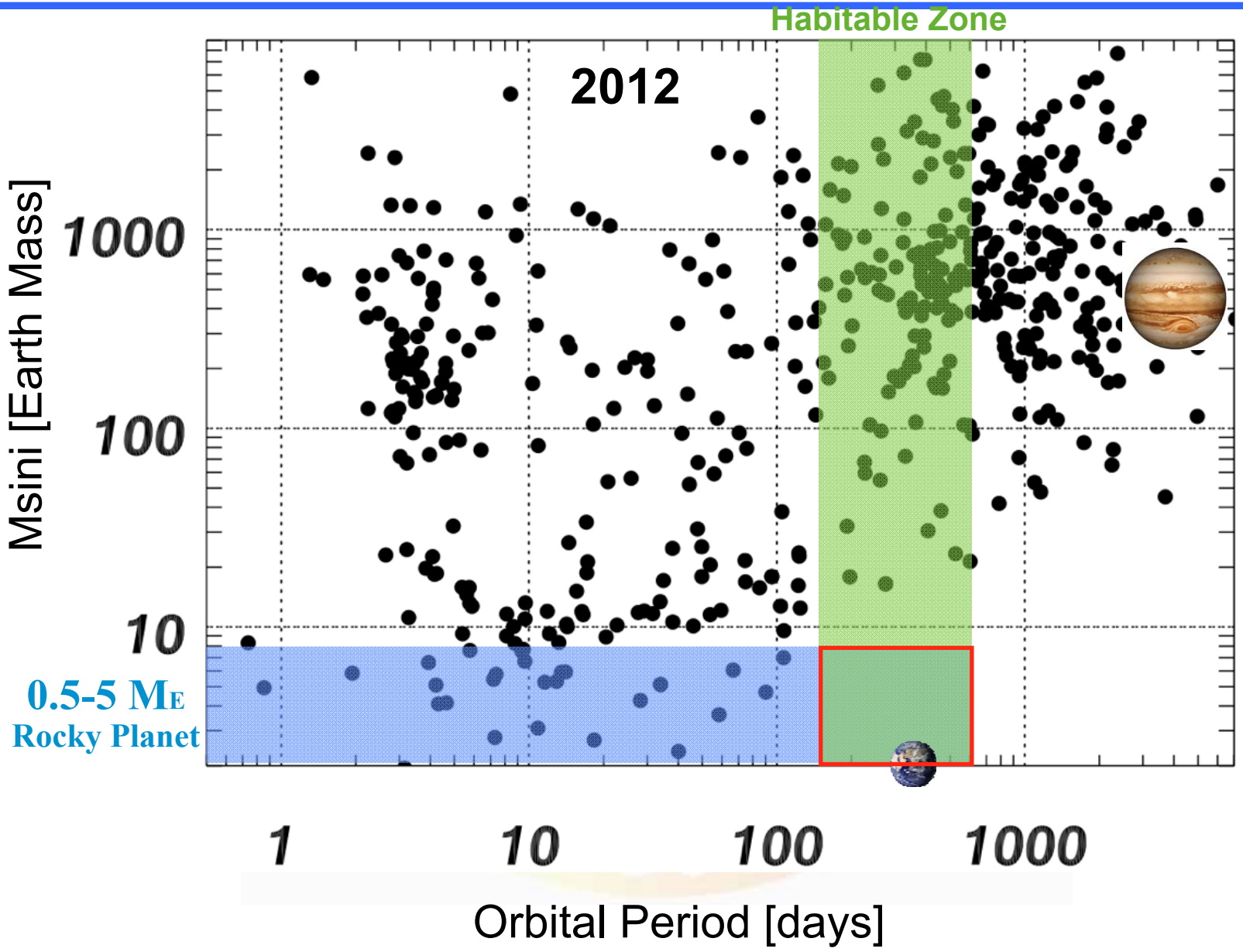




- ◆**Search for nearby(d<20 pc) habitable earth twins**
- ◆**Comprehensive exploration of the structure and diversity of nearby planetary system**
- ◆**Calibration of the distance indicators of the universe**

(Cepheids, improve the current accuracy from 10% to 0.3%, which will improve all the subsequent steps in the distance scale)

We're Waiting for the First Terrestrial-planet

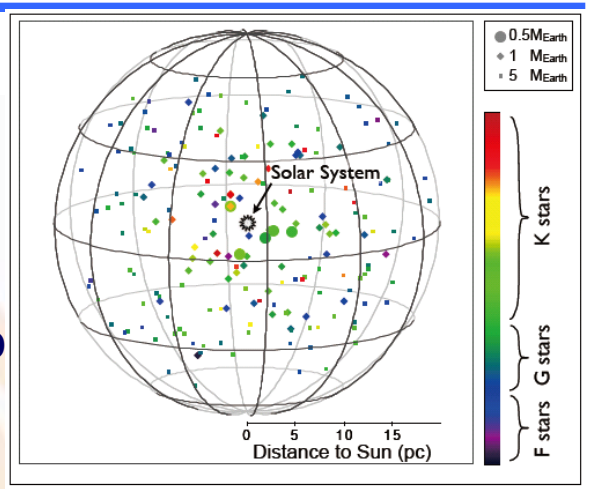


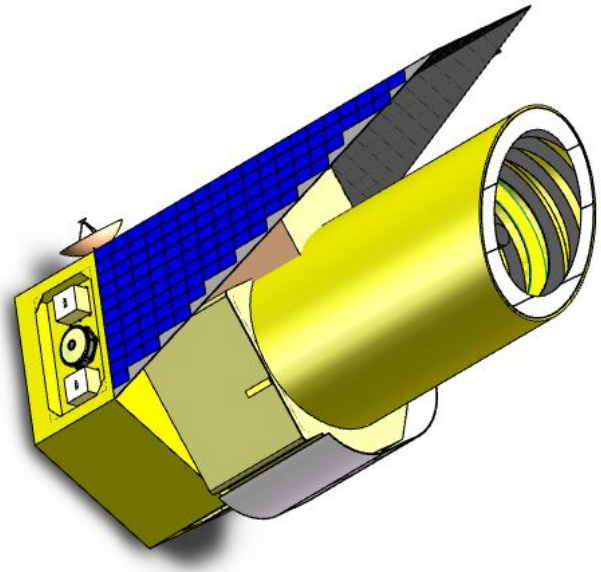
Search for Terrestrial Exo-Planets(STEP)

➢Satellite Specifications / Payloads:

- ✓**Orbit:** Solar-earth L2 Halo
- ✓**Mass:** 500 kg **Life time:** 5 year
- ✓**Payloads:** TMA, Cassegrain Astrometric Telescop

(Primary Aperture: 1.2m, f=50m, FOV: 0.44°)





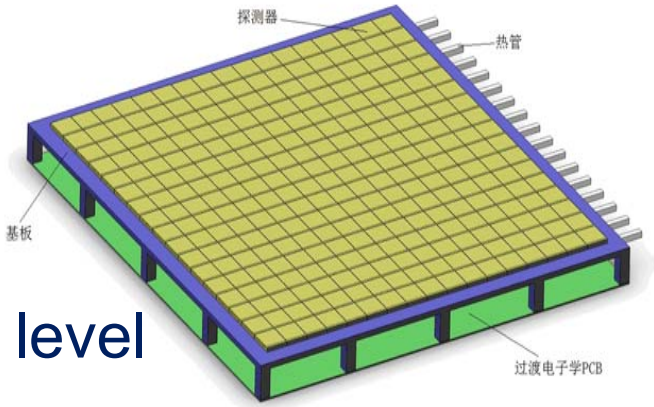
➢ Highlights

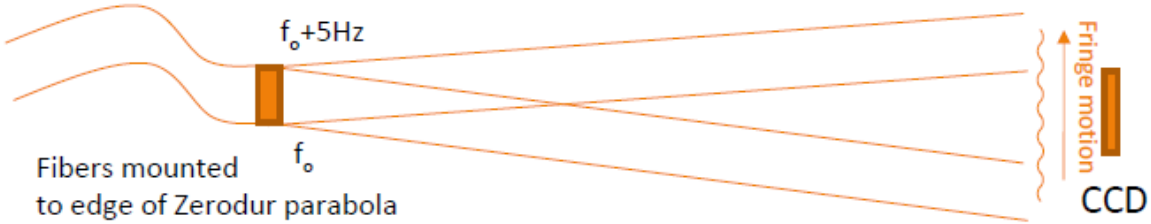
- ✓ Extremely-high-precision(1 uas) astrometric space mission
- ✓ Able to detect the habitable planets at earth criterion
- ✓ Get the actual planetary masses and the full orbital geometry for all components of the detected planetary system

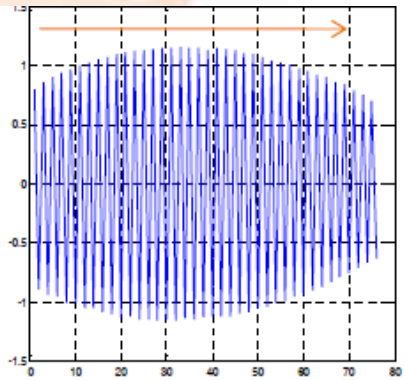
Key Technology in STEP:

Calibrating CCD Centroiding Errors!

- Two/three classes of errors
  - Pixels are not uniformly spaced
  - QE within a pixel is not uniform
  - Error in the assumed PSF
- Measuring Pixel positions at the upixel level
- Measuring QE variations within a pixel
- Nyquist sampling and measuring the PSF.
- 50Hz, Mosaic, 1e read noise, monolithic,no lenslet array



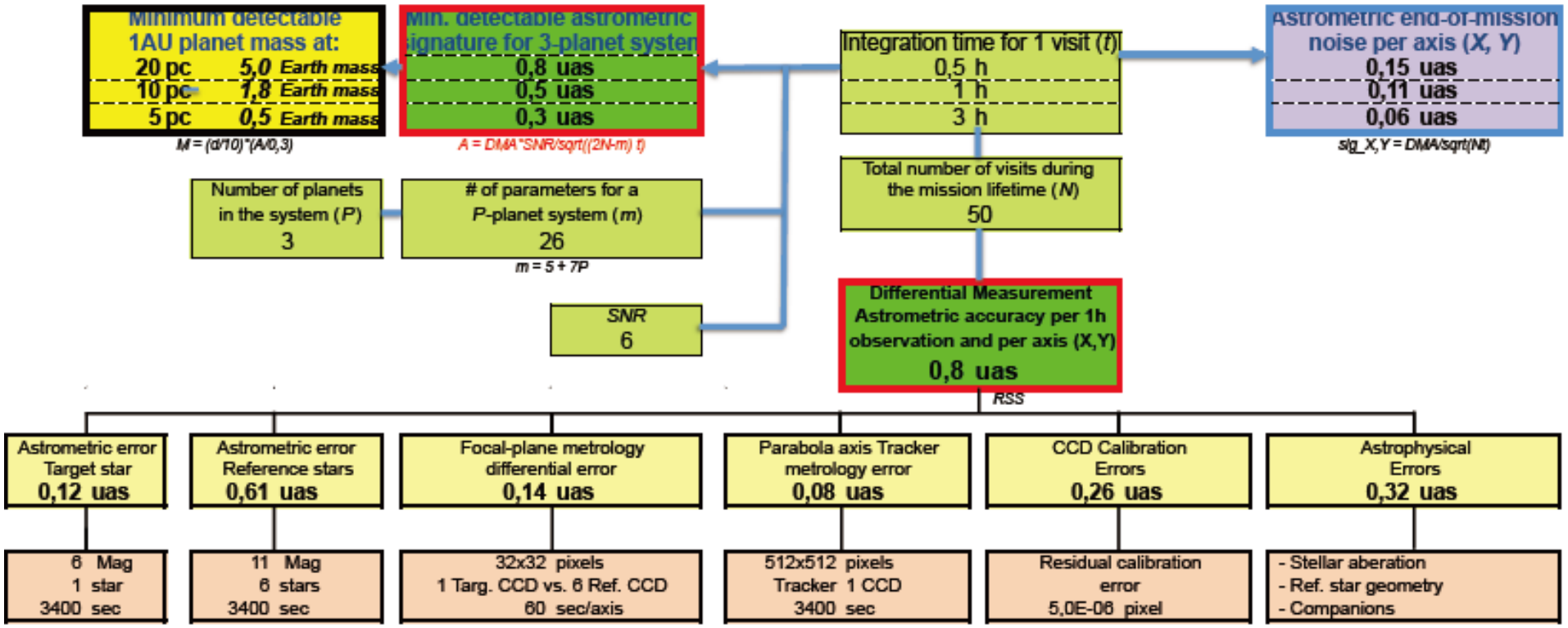


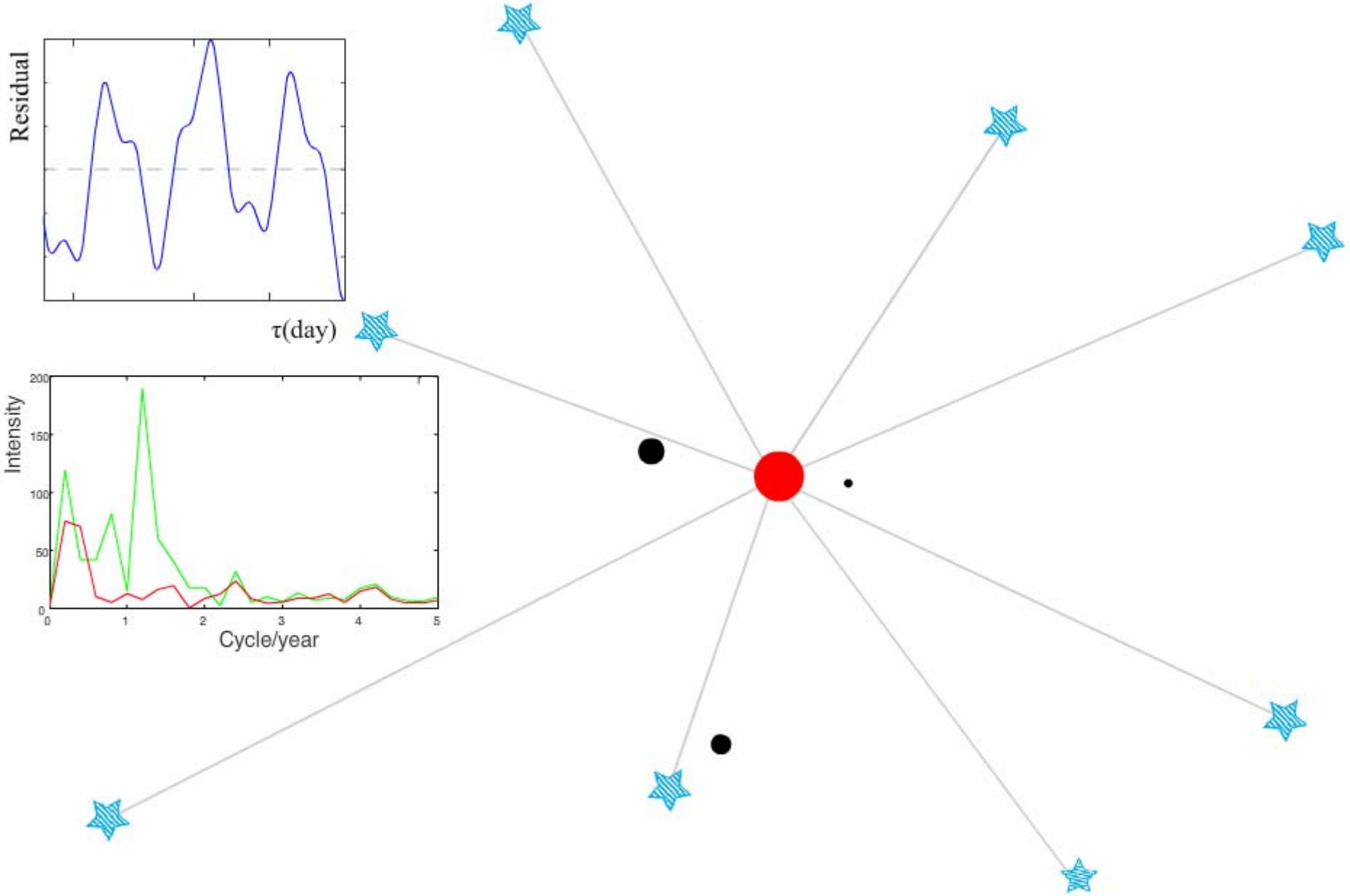


Remarks

- A big STEP on Terrestrial Planet Detection
- A Giant STEP on Space Astrometry
- An important STEP for Chinese Space Science and Exploration
- An Opportunity to STEP in the front of Planetary Science
- International collaboration are welcome!

Extra Slide
Error budget (NEAT/STEP)




Residual
τ(day)
Intensity
200
150
100
50
0
0
1
2
3
4
5
Cycle/year